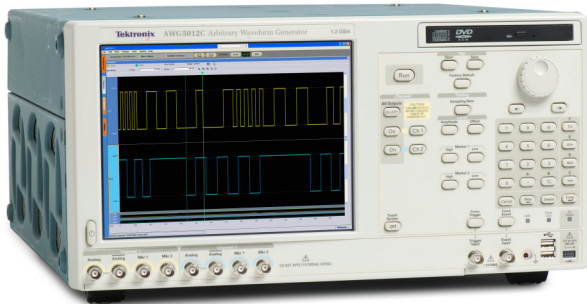


# Arbitrary Waveform Generators

## AWG5000 Series Data Sheet



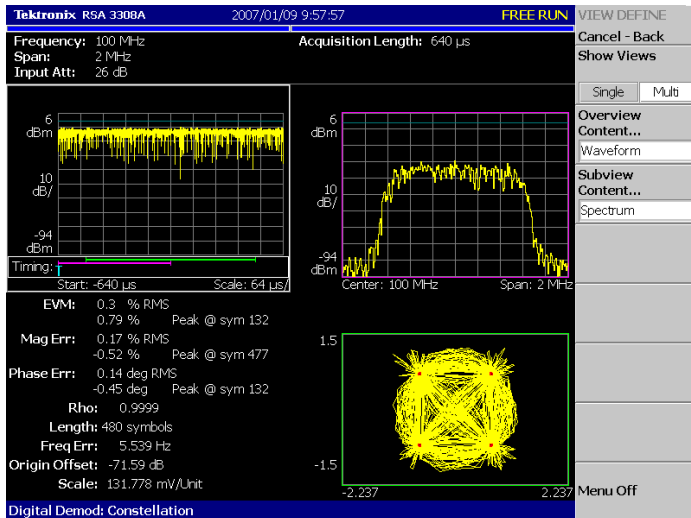
### Features & Benefits

- 480 MHz Carrier, High Dynamic Range RF Signals
- High Dynamic Range IF Signals with Up to 180 MHz Modulation Bandwidth
  - 180 MHz Modulation Bandwidth with  $-58$  dBc SFDR
- Only Stand-alone AWG with 4 Channels Simplifies Test Setup and Reduces Uncertainty
- RFXpress Software enables Quick Creation of Digitally Modulated and Radar Signals
- Waveform Sequencing and Subsequencing
  - Enables Creation of Infinite Waveform Loops, Jumps, and Conditional Branches
  - Enhance the Ability to Replicate Real-world Signal Behavior
- Dynamic Jump Capability
  - Enables the Creation of Complex Waveforms that Respond to Changing External Environment

- 2 or 4 Differential/Single-ended Outputs provide Testing Flexibility
- Up to 8 Marker Outputs ideal for System Synchronization
- 28 Digital Output Channels Create Highly Precise Digital Signals
- Deep Memory enables the Creation of Long Complex Waveform Sequences
- Playback of Signals Captured on Scopes and Real-time Spectrum Analyzers allows for Simulation of Real-world Environments
- Down to 800 ps Resolution Edge Timing Shift Control
- 8,000 Steps Real-time Sequencing Creates Infinite Waveform Loops, Jumps, and Conditional Branches
- Easy to Use and Learn, Shortens Test Time
- Convenient Benchtop Form Factor
- Integrated PC supports Network Integration and provides a Built-in DVD, Removable Hard Drive, LAN, and USB Ports

### Applications

- High-resolution Wireless Communications and Defense Electronics
- Education and Research
- ADC/DAC Testing
- Mixed-signal Design and Test
- Real-world, Ideal, or Distorted Signal Generation – Including all the Glitches, Anomalies, and Impairments
- System Synchronization and Timing Control for Large-scale Test Systems



EVM/Constellation Measurement.

## Industry's Best Mixed-signal Stimulus Solution for Today's Complex Measurement Challenges

The AWG5000 Series of Arbitrary Waveform Generators delivers the optimal combination of sample rate, vertical resolution, signal fidelity, and waveform memory length, all in an easy-to-use self-contained package. The series offers the industry's best solution to the challenging signal stimulus issues faced by designers verifying, characterizing, and debugging sophisticated electronic designs.

Meeting the needs of today's design engineers, the series provides excellent dynamic range over all modulation bandwidths. AWG5000 Series models, with a 14-bit DAC, sample rates up to 1.2 GS/s, 2 to 4 output channels, synchronized 4 to 8 digital marker outputs, and 28 channels of digital data outputs, easily solve the toughest measurement challenges in wireless communications, defense electronics, digital consumer product design, data conversion equipment, test system synchronization, and semiconductor design and test.

The open windows (Windows 7) based instruments are easy, convenient to use, and connect with peripherals and other third-party software.

The capabilities of the AWG5000 Series are further enhanced by the addition of key features:

### Equation Editor

The Equation Editor is an ASCII text editor that uses text strings to create waveforms by loading, editing, and compiling equation files. The editor provides control and flexibility to create more complex waveforms using customer-defined parameters.

### Waveform Sequencing and Subsequencing

Real-time sequencing creates infinite waveform loops, jumps, and conditional branches for longer pattern-length generation suitable for replicating real-world behavior of serial transmitters.

### Dynamic Jump

The Dynamic Jump capability enables the creation of complex waveforms by enabling the ability to dynamically jump to any predefined index in a waveform sequence. Users can define up to 16 distinct jump indexes that respond to changing external environments.

### Wireless I/Q and IF Signal Generation

The AWG5000 Series provides good SFDR over modulation bandwidths up to 180 MHz, meeting the demands of IQ and IF signal generation.

The RFXpress (RFX100) software package utilizes the raw AWG performance to simplify the creation of RF signals. Supporting a wide range of modulation schemes, the software is flexible enough to create either generic or propriety signals for digital communication systems. Power ramping, frequency hopping, and impairments can easily be added to generate the desired signal.

**Radar Signal Creation** is a software module for RFXpress that gives you the ultimate flexibility in creating pulsed radar waveforms. It gives you the ability to build your own radar pulse suite starting from pulse-to-pulse trains to pulse groups. It supports a variety of modulation schemes including LFM, Barker and Polyphase Codes, User-defined Codes, Step FM, Nonlinear FM, User-defined FM, and Custom modulation. It also has the ability to generate pulse trains with staggered PRI to resolve range and doppler ambiguity, frequency hopping for Electronic Counter-Counter Measures (ECCM), and pulse-to-pulse amplitude variation to simulate Swerling target models including antenna scan patterns, clutter, and multipath effects. RFXpress is a powerful easy-to-use software package to synthesize IQ and IF signals for arbitrary waveform generators. It runs as an integral part of the AWG5000 Series or from an external PC.

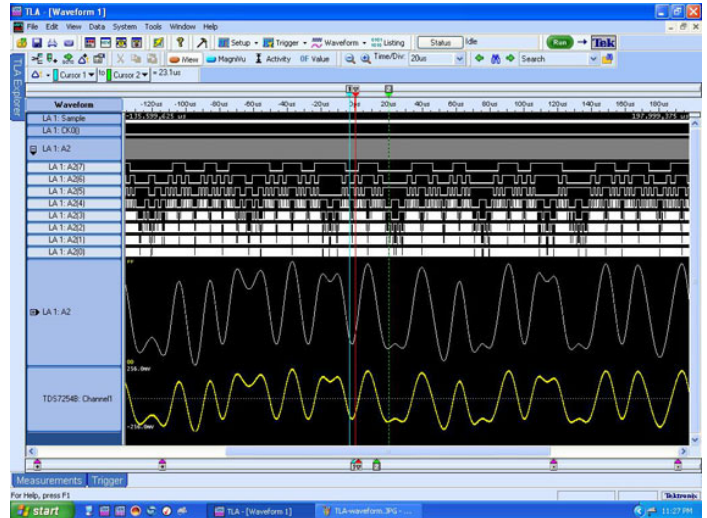
## Environment Signal Generation

Radar signals must coexist with other commercial standard signals sharing the same spectrum, yet are still expected to perform with no performance degradation. This isn't unreasonable given its mission-critical operations. To meet this expectation, a radar designer has to thoroughly test all the corner cases at the design/debug stage. The AWG5000 and RFXpress Environment plug-in offers extreme flexibility to define and create these worst-case scenarios.

You can specify up to 25 signals to define your environment, including WiMAX, WiFi, GSM, GSM-EDGE, EGPRS 2A, EGPRS2B, CDMA, W-CDMA, DVB-T, Noise, and CW Radar. This plug-in also allows you to seamlessly import signals from other RFXpress plug-ins (including Radar, Generic Signal, etc.), as well as from Matlab® and from Tektronix spectrum analyzers and oscilloscopes, into your environment. You can also configure PHY parameters of your standard-specific signals. You can define the carrier frequency, power, start time, and duration for all the signals in your environment, so you have full control over the way these signals interact/interfere with each other.

## Mixed-signal Generation

AWG5012 and AWG5002 models have an optional 28 digital output channels with high-resolution edge placement, making them a great



Mixed-signal test by TDS/TLA iView.

solution for digital signal generation applications, such as digital design and validation, system synchronization, and ADC/DAC testing.

## Characteristics

### Definitions

**Specifications** (not noted) – Product characteristics described in terms of specified performance with tolerance limits which are warranted/guaranteed to the customer. Specifications are checked in the manufacturing process and in the Performance Verification section of the product manual with a direct measurement of the parameter.

**Typical** (noted) – Product characteristics described in terms of typical performance, but not guaranteed performance. The values given are never warranted, but most units will perform to the level indicated. Typical characteristics are not tested in the manufacturing process or the Performance Verification section of the product manual.

**Nominal** (noted) – Product characteristics described in terms of being guaranteed by design. Nominal characteristics are non-warranted, so they are not checked in the manufacturing process or the Performance Verification section of the product manual.

### AWG5000C Series Specifications

#### General Characteristics

Characteristic	AWG5014C	AWG5012C	AWG5002C
Digital to Analog Converter			
Sample rate	10 MS/s to 1.2 GS/s		10 MS/s to 600 MS/s
Resolution	14 bit		
Sin (x)/x Roll-off			
Sin (x)/x (-1 dB)	300 MHz		150 MHz
Sin (x)/x (-3 dB)	520 MHz		260 MHz

## Frequency Domain Characteristics

Characteristic	AWG5014C	AWG5012C	AWG5002C
<b>Output Frequency Characteristics</b>			
Effective Frequency Output	Fmaximum (specified) is determined as "sample rate / oversampling rate" or "SR/2.5"		
Fmaximum	480 MHz		240 MHz
Fmaximum (typical)	540 MHz		275 MHz
Effective Frequency Switching Time	Minimum frequency switching time from selected frequencies $F_1$ to $F_2$ is determined as "1/Fmaximum"		
Standard			
Ts	2.1 ns		4.2 ns
Ts (typical)	1.8 ns		3.7 ns
Modulation Bandwidth	Modulation bandwidth is a combination of $\sin(x)/x$ and rise time bandwidths, defined as the lower of the $\sin(x)/x$ bandwidth or the calculated percentage of rise time bandwidth (as shown)		
Mod bandwidth (-1 dB) (typical) -1 dB BW = $0.932 \times (-1 \text{ dB TrBW})$	Normal: Up to 130 MHz Direct: Up to 180 MHz		Normal: Up to 100 MHz Direct: Up to 130 MHz
Mod bandwidth (-3 dB) (typical) -3 dB BW = $0.913 \times (-3 \text{ dB TrBW})$	Normal: Up to 230 MHz Direct: Up to 300 MHz		Normal: Up to 180 MHz Direct: Up to 230 MHz
<b>Output Amplitude Characteristics</b>			
Amplitude	Amplitude levels are measured as single-ended outputs. Amplitude level will be 3 dBm higher when using differential (both) outputs		
Range	Normal: -30 dBm to 17 dBm Direct: -30 dBm to 0 dBm		
Resolution	0.01 dB		
Accuracy	At 0 dBm level, with no offset, $\pm 0.3$ dB		
Output Flatness	Mathematically corrected for characteristic $\sin(x)/x$ roll-off, uncorrected by external calibration methods		
Flatness (typical)	$\pm 1.0$ dB, from 10 MHz to 480 MHz		
Digital Data Out (Option 03)			
Number of outputs	14-bit output on Ch1 and Ch2 (28 total)		
Output connector	SMB (rear panel), single ended		
Output impedance	50 $\Omega$		
Digital Data Out Levels (into 50 $\Omega$ )			
Window	-1.0 V to 2.7 V		
Amplitude	0.1 $V_{p-p}$ to 3.7 $V_{p-p}$		
Resolution	10 mV		
Accuracy	$\pm(10\%$ of setting + 120 mV)		
Current (max)	$\pm 54$ mA per channel		
Rise/Fall time (20% to 80%)	300 ps (1.0 $V_{p-p}$ , Hi: 1.0 V, Lo: 0 V)		
Delay from marker	-41 ns to -82 ns		
Skew between outputs	<400 ps		

**Time Domain Characteristics**

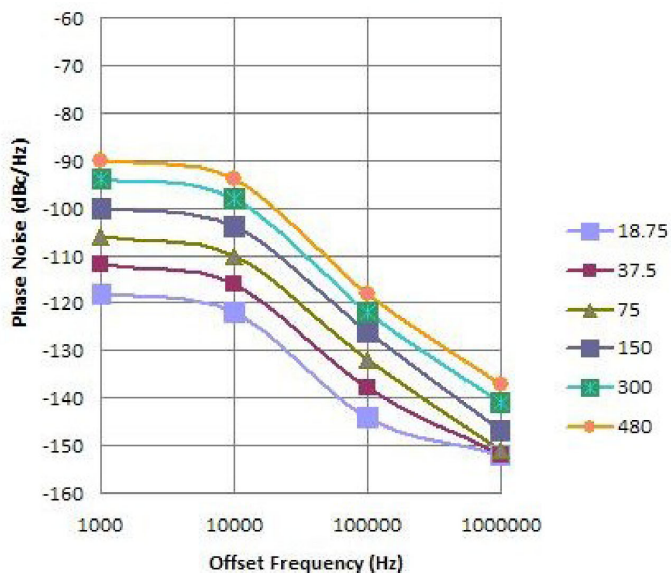
Characteristic	AWG5014C	AWG5012C	AWG5002C
<b>Data Rate Characteristics</b>			
Data Rate	Bit rate is determined as "sample rate / 4 points per cycle", allowing full impairment generation		
Bit rate (typical)	300 Mb/s		150 Mb/s
<b>Rise/Fall Time Characteristics</b>			
Rise/Fall Time	Rise/Fall time measured at 10% to 90% levels		
Tr/Tf	Normal: 1.4 ns Direct: 0.95 ns		
Rise Time Bandwidth	Rise-time bandwidth converted from rise-time ( $0.34/T_r$ , assumed Gaussian transition) characteristics through analog output circuitry and cabling		
Tr bandwidth (-1 dB) (typical)	Normal: 140 MHz Direct: 210 MHz		
Tr bandwidth (-3 dB) (typical)	Normal: 250 MHz Direct: 370 MHz		
Low-pass filter	Normal: Bessel Type, 50 and 100 MHz		
<b>Output Amplitude Characteristics</b>			
Amplitude	Amplitude levels are measured between differential outputs (+) and (-) For single-ended output (+) the amplitude level will be one-half the levels below		
Range	Normal: 40 mV <sub>p-p</sub> to 9.0 V <sub>p-p</sub> Direct: 40 mV <sub>p-p</sub> to 1.2 V <sub>p-p</sub>		
Resolution	1.0 mV		
Accuracy	At 0.5 V, with no offset, $\pm(2\%$ of amplitude $\pm 2$ mV)		
Offset			
Range	Normal: $\pm 2.25$ V		
Resolution	1.0 mV		
Accuracy	At minimum amplitude, $\pm(2.0\%$ of offset $\pm 10$ mV)		

**Common Characteristics**

Characteristic	AWG5014C	AWG5012C	AWG5002C
<b>Output Distortion Characteristics</b>			
Spurious Free Dynamic Range (SFDR)	SFDR is determined as a function of the directly generated carrier frequency. Harmonics not included		
SFDR (Direct) (typical)	Clock: 1.2 GS/s, 14-bit operation Frequency: 10 MHz to 480 MHz Level: 4 dBm (1 V <sub>p-p</sub> ) Offset: None		Clock: 0.6 GS/s, 14-bit operation Frequency: 10 MHz to 240 MHz Level: 4 dBm (1 V <sub>p-p</sub> ) Offset: None
DC to 10 MHz carrier	-70 dBc		-74 dBc
10 to 20 MHz carrier	-70 dBc		-70 dBc
20 to 40 MHz carrier	-62 dBc		-62 dBc
40 to 80 MHz carrier	-62 dBc		-57 dBc
80 to 150 MHz carrier	-58 dBc		-54 dBc
150 to 300 MHz carrier	-58 dBc		-54 dBc
300 to 480 MHz carrier	-56 dBc		
Spurious Free Dynamic Range (SFDR)	When viewed as a modulation bandwidth and used with external frequency up-conversion, the specifications will hold and be independent of carrier frequency with proper conversion circuitry design. Harmonics not included		
SFDR (Direct) (typical)	Clock: 1.2 GS/s, 14-bit operation Modulation Bandwidth: Up to 180 MHz Level: 4 dBm (1 V <sub>p-p</sub> ) Offset: None		Clock: 0.6 GS/s, 14-bit operation Modulation Bandwidth: Up to 130 MHz Level: 4 dBm (1 V <sub>p-p</sub> ) Offset: None
DC to 10 MHz bandwidth	-70 dBc		-74 dBc
DC to 20 MHz bandwidth	-70 dBc		-70 dBc
DC to 40 MHz bandwidth	-62 dBc		-62 dBc
DC to 80 MHz bandwidth	-62 dBc		-57 dBc
DC to 150 MHz bandwidth	-58 dBc		-54 dBc
DC to 180 MHz bandwidth	-58 dBc		

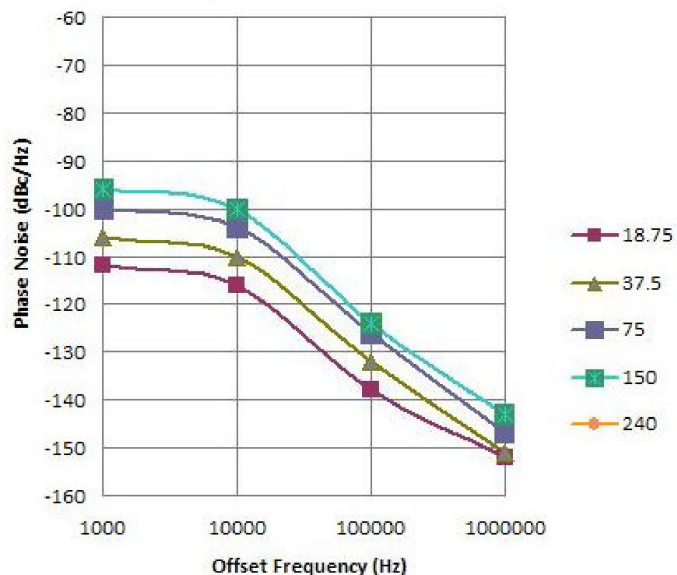
Characteristic	AWG5014C	AWG5012C	AWG5002C
Harmonic Distortion		Clock: 1.2 GS/s, 14-bit operation 32-point waveform 37.5 MHz output Normal: 10 dBm (2.0 V <sub>p-p</sub> ) Direct: 0 dBm (0.6 V <sub>p-p</sub> ) Offset: None	Clock: 0.6 GS/s, 14-bit operation 32-point waveform 18.7 MHz output Normal: 10 dBm (2.0 V <sub>p-p</sub> ) Direct: 0 dBm (0.6 V <sub>p-p</sub> ) Offset: None
Harmonics		Normal: <40 dBc Direct: <49 dBc	Normal: <46 dBc Direct: <55 dBc
Nonharmonic Distortion		Clock: 1.2 GS/s, 14-bit operation Frequency: 10 MHz to 480 MHz Level: 4 dBm (1 V <sub>p-p</sub> ) Offset: None	Clock: 0.6 GS/s, 14-bit operation Frequency: 10 MHz to 240 MHz Level: 4 dBm (1 V <sub>p-p</sub> ) Offset: None
Spurious		< -60 dBc	
Phase Noise		Clock: 1.2 GS/s, 14-bit operation 32-point waveform 37.5 MHz output Amplitude: 10 dBm (2 V <sub>p-p</sub> ) at 0 offset, <-85 dBc/Hz at 10 kHz offset	Clock: 0.6 GS/s, 14-bit operation 32-point waveform 18.7 MHz output Amplitude: 10 dBm (2 V <sub>p-p</sub> ) at 0 offset, <-85 dBc/Hz at 10 kHz offset
Jitter			
Random jitter (typical)		1010 clock pattern	
RMS value		Normal: 5.0 ps	
Total jitter (typical)		2 <sup>15</sup> - 1 data pattern (at 10 <sup>-12</sup> BER)	
Peak-Peak value		Normal: 150 ps at 0.5 Gb/s	

**AWG5014C / 5012C**  
Sample Rate - 1.2 GS/s



AWG5014C/5012C phase noise (typical).

**AWG5002C**  
Sample Rate - 600 MS/s



AWG5002C phase noise (typical).



**AWG5000C Series Common Features****Common Hardware Characteristics**

Characteristic	AWG5014C	AWG5012C	AWG5002C
Number of Outputs	4 channels		2 channels
Output connector		Differential, BNC (front panel)	
Output impedance		50 $\Omega$	
Waveform Length		Standard – to 16M points Extended memory – to 32M points	
Number of Waveforms		1 to 16,200	
Sequence Length/Counter		1 to 16,000 steps 1 to 65,536 count	
Run Modes			
Continuous	Waveform is iteratively output. If a sequence is defined, the sequence order and repeat functions are applied		
Triggered	Waveform is output only once when an internal, external, programmatic (GPIB, LAN), or manual trigger is received		
Gated	Waveform begins output when gate is "True" and resets when gate is "False"		
Sequence	Waveform is output as defined by the sequence selected		
Jump	Synchronous and asynchronous		
Sampling Clock			
Resolution		8 digits	
Accuracy		Within $\pm(1 \text{ ppm} + \text{Aging})$ Aging: Within $\pm 1 \text{ ppm}$ per year	
Internal Trigger Generator			
Range		1.0 $\mu\text{s}$ to 10.0 s	
Resolution		3 digits, 0.1 $\mu\text{s}$ minimum	
Output Skew Control			
Range		-5 ns to 5 ns	
Resolution		5 ps	

**Common Software Characteristics**

Characteristic	AWG5014C	AWG5012C	AWG5002C
Operating System / Peripherals / IO		Windows 7 4 GB memory CD/DVD drive (front panel) 160 GB hard disk drive (rear-panel removable, optional front mount kit) USB compact keyboard and mouse USB 2.0 compliant ports (6 total – 2 front, 4 rear) PS/2 mouse and keyboard connections (rear panel) RJ-45 Ethernet connector (rear panel) supports 10/100/1000BASE-T eSATA (rear panel) DVI/I Video (rear panel)	
Display Characteristics		LED backlit monitor with touch screen, 10.4 in. (264 mm) 1024 x 768 (V) XGA	
Waveform File Import Capability		Import waveform format by series: *.AWG file created by Tektronix AWG5000 or AWG7000 Series *.PAT, *.SEQ, *.WFM, and *.EQU file formats created by Tektronix arbitrary waveform generators such as the AWG400/500/600/700 Series *.TIQ and *.IQT files created by Tektronix real-time spectrum analyzers *.TFW file created by Tektronix AFG3000 Series arbitrary/function generators *.DTG file created by Tektronix DTG5000 Series data timing generators *.WFM or *.ISF file created by Tektronix TDS/DPO Series oscilloscopes text file (*.TXT)	
Waveform File Export Capability		Export waveform format by series: Tektronix AWG400/500/600/700 (*.wfm or *.pat) and text format	
Software Driver for Third-party Applications		IVI-COM driver, MATLAB library	
Instrument Control / Data Transfer			
GPIB	Remote control and data transfer (conforms to IEEE-Std 488.1, compatible with IEEE-Std 488.2 and SCPI-1999.0)		
Ethernet	Remote control and data transfer (conforms to IEEE-Std 802.3)		
TekLink	Remote control and data transfer (proprietary bus for Tektronix product high-speed interconnection and communication)		

## Auxiliary Outputs

Characteristic	AWG5014C	AWG5012C	AWG5002C
<b>Markers</b>			
Number	Total: 8 (2 per channel)	Total: 4 (2 per channel)	
Style	Single ended		
Connector	BNC (front panel)		
Impedance	50 $\Omega$		
Level (into 50 $\Omega$ )	Amplitude levels are measured between differential outputs (+) to (-) Single-ended output amplitude level will be one-half the voltage levels below		
Window	-2.0 V to 5.4 V		
Amplitude	0.2 V <sub>p-p</sub> to 7.4 V <sub>p-p</sub>		
Resolution	10 mV		
Accuracy	$\pm(10\%$ of setting + 120 mV)		
Rise/Fall time (20% to 80%)	300 ps (1.0 V <sub>p-p</sub> , Hi: 1.0 V, Lo: 0.0 V)		
<b>Timing skew</b>			
Range	0 to 1000 ps		
Resolution	50 ps		
<b>Delay control</b>			
Range	0 to 300 ps		
Resolution	1 ps		
Accuracy	$\pm(5\%$ of setting + 50 ps)		
<b>Jitter</b>			
Random RMS (typical)	5 ps		
Total p-p (typical)	80 ps (2 <sup>15</sup> - 1 PN pattern at 10 <sup>-12</sup> BER)		
<b>10 MHz Reference Out</b>			
Amplitude	1.2 V <sub>p-p</sub> into 50 $\Omega$ , maximum 2.5 V open		
Connector	BNC (rear panel)		
Impedance	50 $\Omega$ , AC coupled		
<b>Clock Out (VCO)</b>			
Range	600 MHz, 1.2 GHz		
Amplitude	0.4 V <sub>p-p</sub> into 50 $\Omega$ to ground		
Connector	BNC (rear panel)		
Impedance	50 $\Omega$ , AC coupled		
<b>DC Outputs</b>			
Number	4, independently controlled		
Range	-3.0 V to 5.0 V		
Resolution	10 mV		
Accuracy	$\pm(3\%$ of setting + 120 mV)		
Connector	2x4 pin header (front panel)		
Current (max)	$\pm 100$ mA		

## Auxiliary Inputs

Characteristic	AWG5014C	AWG5012C	AWG5002C
<b>Trigger / Gate In</b>			
Polarity		Pos or Neg	
Range		50 $\Omega$ : $\pm 5$ V 1 k $\Omega$ : $\pm 10$ V	
Jitter (typical)		2.0 ns to 4.5 ns	
Connector		BNC (front panel)	
Impedance		50 $\Omega$ , 1 k $\Omega$	
<b>Threshold</b>			
Level		-5.0 V to 5.0 V	
Resolution		0.1 V	
<b>Trigger to output uncertainty</b>			
Asynchronous (typical)		Between internal/external clock and trigger timing: 2.0 ns to 4.5 ns	
<b>Trigger mode</b>			
Minimum pulse width		20 ns	
Trigger hold-off		160 $\times$ sampling period - 200 ns	
Delay to output		48 $\times$ sampling period + 500 ns	
<b>Gated mode</b>			
Minimum pulse width		1024 $\times$ sampling period + 10 ns	
Delay to output		240 $\times$ sampling period + 500 ns	
<b>Event In</b>			
Polarity		Pos or Neg	
Range		50 $\Omega$ : $\pm 5$ V 1 k $\Omega$ : $\pm 10$ V	
Connector		BNC (front panel)	
Impedance		50 $\Omega$ , 1 k $\Omega$	
<b>Threshold</b>			
Level		-5.0 V to 5.0 V	
Resolution		0.1 V	
<b>Sequence mode</b>			
Minimum pulse width		20 ns	
Event hold-off		200 $\times$ sampling period + 500 ns	
Delay to output		260 $\times$ sampling period + 300 ns (Jump timing: asynchronous jump)	
<b>External Clock In</b>			
Input voltage range		0.2 $V_{p-p}$ to 0.8 $V_{p-p}$ , -10 dBm to 2 dBm	
Frequency range		600 MHz to 1.2 GHz (acceptable frequency drift of $\pm 5\%$ )	
Clock divider		1/1, 1/2, 1/4...1/256	
Connector		BNC (rear panel)	
Impedance		50 $\Omega$ , AC coupled	
<b>Fixed Reference Clock In</b>			
Input voltage range		0.2 $V_{p-p}$ to 3.0 $V_{p-p}$ , -10 dBm to 14 dBm	
Frequency range		10 MHz, 20 MHz, 100 MHz (within $\pm 0.1\%$ )	
Connector		BNC (rear panel)	
Impedance		50 $\Omega$ , AC coupled	

Characteristic	AWG5014C	AWG5012C	AWG5002C
<b>Phase Lock In</b>			
Input voltage range	0.2 V <sub>p-p</sub> to 3.0 V <sub>p-p</sub> , -10 dBm to 14 dBm		
Frequency range	5 MHz to 600 MHz (acceptable frequency drift is ±0.1%)		
Multiplier rate	1 to 240		
Connector	BNC (rear panel)		
Impedance	50 Ω, AC coupled		
<b>Add In</b>			
Input voltage range	±1.0 V		
DC gain	1		
Bandwidth	DC to 100 MHz (-3 dB)		
Connector	BNC (rear panel)		
Impedance	50 Ω, AC coupled		

### Physical Characteristics

Dimension	mm	in.
Height	245	9.6
Width	465	18
Depth	500	19.7
Weight	kg	lb.
Net (instrument)	19.5	43
Net (with packaging)	28.5	62.8
Mechanical Cooling		
Clearance	cm	in.
Top/Bottom	2	0.8
Side	15	6
Rear	7.5	3
Power Supply		
Rating	100 to 240 V AC, 47 to 63 Hz	
Consumption	450 Watts	

### Environmental Characteristics

Characteristic	Description
<b>Temperature</b>	
Operational	10 to 40 °C
Nonoperational	20 to 60 °C
<b>Humidity</b>	
Operational	5% to 80% relative humidity (% RH) at up to 30 °C, 5% to 45% relative humidity above 30 °C up to 50 °C
Nonoperational	5% to 90% relative humidity (% RH) at up to 30 °C, 5% to 45% relative humidity above 30 °C up to 50 °C
<b>Altitude</b>	
Operational	Up to 10,000 ft. (3,048 m)
Nonoperational	Up to 40,000 ft. (12,192 m)
<b>Vibration</b>	
<b>Sine</b>	
Operational	0.33 mm p-p (0.013 in p-p) constant displacement, 5 to 55 Hz
Nonoperational	N/A
<b>Random</b>	
Operational	0.27 g RMS, 5 to 500 Hz, 10 minutes per axis
Nonoperational	2.28 g RMS, 5 to 500 Hz, 10 minutes per axis
<b>Mechanical Shock</b>	
Operational	Half-sine mechanical shocks, 30 g peak, 11 ms duration, 3 drops in each direction of each axis
Nonoperational	Half-sine mechanical shocks, 10 g peak, 11 ms duration, 3 drops in each direction of each axis
<b>Regulatory</b>	
Safety	UL61010-1, CAN/CSA-22.2, No.61010-1-04, EN61010-1, IEC61010-1
Emissions	EN55011 (Class A), IEC61000-3-2, IEC61000-3-3
Immunity	IEC61326, IEC61000-4-2/3/4/5/6/8/11
<b>Regional certifications</b>	
Europe	EN61326
Australia / New Zealand	AS/NZS 2064

## Ordering Information

### Arbitrary Waveform Generator Mainframe

#### AWG5014C

1.2 GS/s, 14-bit resolution, 16M point per channel, 4-channel arbitrary waveform generator

#### AWG5012C

1.2 GS/s, 14-bit resolution, 16M point per channel, 2-channel arbitrary waveform generator

#### AWG5002C

600 MS/s, 14-bit resolution, 16M point per channel, 2-channel arbitrary waveform generator

**All Models Include:** Accessory pouch, front cover, USB mouse, compact USB keyboard, lead set for DC output, AWG5000C Series product software CD and instructions, documentation CD with browser, Quick Start User Manual and registration card, Certificate of Calibration, and power cable.

**Note:** Please specify power cord and language option when ordering.

### Instrument Options

Option	Description
<b>AWG5014C/AWG5012C/AWG5002C</b>	
Opt. 01	Waveform Length Expansion (from 16M to 32M)
Opt. 09	Subsequencing and Dynamic Jump option (subsequencing files created for legacy AWG400, AWG500, AWG600, and AWG700 instrument are compatible with this option)
<b>AWG5012C/AWG5002C</b>	
Opt. 03	28-bit digital data outputs (digital data of CH1 and CH2) <b>Note:</b> Must be ordered at time of purchase
Opt. 0309	Combination of Option 03 and Option 09 <b>Note:</b> Must be ordered at time of purchase

### Common Options

#### International Power Plugs

Option	Description
Opt. A0	North America
Opt. A1	Universal EURO
Opt. A2	United Kingdom
Opt. A3	Australia
Opt. A5	Switzerland
Opt. A6	Japan
Opt. A10	China
Opt. A11	India
Opt. A99	No power cord or AC adapter

#### Language Options

Option	Description
Opt. L0	English
Opt. L5	Japanese
Opt. L7	Simplified Chinese
Opt. L8	Traditional Chinese
Opt. L10	Russian

### Application Software

Model	Option	Description
RFX100		General-purpose IQ, IF, and RF Signal Creation Software Package
	Opt. UWBCF	RFXpress plug-in for UWB-WiMedia IQ, IF, and RF conformance signal creation (requires RFX100 as prerequisite)
	Opt. UWBCT	RFXpress plug-in for UWB-WiMedia IQ, IF, and RF custom and conformance signal creation (requires RFX100 as prerequisite and includes Opt. UWBCF)
	Opt. OFDM	RFXpress plug-in for generic OFDM signal creation (requires RFX100 as prerequisite)
	Opt. RDR	RFXpress plug-in for radar signal creation (requires RFX100 as prerequisite)
	Opt. SPARA	S-Parameter emulation and DUT characterization (requires RFX100 as prerequisite)
	Opt. ENV	Environment Signal generation (requires RFX100 as prerequisite)
	Opt. ENV01	Bundling option - Opt ENV + Opt RDR (requires RFX100 as prerequisite)
	Opt. ENV02	Bundling option - Opt ENV + Opt RDR + Opt OFDM (requires RFX100 as prerequisite)
	Opt. ENV03	Bundling option - Opt ENV + Opt RDR + Opt OFDM + Opt SPARA (requires RFX100 as prerequisite)
SDX100		Jitter Generation Software Package (includes USB dongle)
	Opt. ISI	S-Parameter and ISI creation (requires SDX100 as prerequisite)
	Opt. SSC	Spread Spectrum Clock addition option (requires SDX100 as prerequisite)

### Service Options

Option	Description
Opt. CA1	A single calibration event
Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. D1	Calibration Data Report
Opt. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. R3	Repair Service 3 Years
Opt. R5	Repair Service 5 Years

#### Post Sales Service Options: (e.g. AWG5012-CA1)

CA1	A single calibration event
R3DW	Repair Service Coverage 3 Years
R5DW	Repair Service Coverage 5 Years
R2PW	Repair Service Coverage 2 Years Post Warranty
R1PW	Repair Service Coverage 1 Year Post Warranty

**Product Upgrade**

Product	Options to Upgrade	Description	
AWG5014C	AWG50CUP	Opt. M03	Waveform Length Expansion from 16M point to 32M point
		Opt. S49	Upgrade to add subsequencing and dynamic jump. Upgrade from Standard to Option 09 (Subsequencing and table jump functionality, includes LVDS to TTL TekLink Connector Adapter)
AWG5012C	AWG50CUP	Opt. M02	Waveform Length Expansion from 16M point to 32M point
		Opt. S39	Upgrade from Standard to Option 09 (Subsequencing and table jump functionality, includes LVDS to TTL TekLink Connector Adapter)
AWG5002C	AWG50CUP	Opt. M01	Waveform Length Expansion from 16M point to 32M point
		Opt. S19	Upgrade to add subsequencing and dynamic jump. Upgrade from Standard to Option 09 (Subsequencing and table jump functionality, includes LVDS to TTL TekLink Connector Adapter)

**Recommended Accessories**

Item	Description	Part Number
Pin Header Cable		
SMA Cable	40 in. (102 cm)	012-1690-xx
SMB Cable	20 in. (51 cm)	012-1503-xx
Rackmount Kit	Rackmount Kit with Instruction	016-1983-xx
Front Removable HDD Bay	Front Removable HDD Bay	016-1979-xx
Replacement Hard Disk for AWG5000/7000 Series	Accessory Kit, Hard-drive Assembly, V4.0 Programmed FW	650-5336-xx
Quick-start User Manual	English	071-2481-xx
	Japanese	071-2482-xx
	Simplified Chinese	071-2483-xx
	Traditional Chinese	071-2484-xx
	Russian	020-2971-xx
Programmer Manual	English	077-0061-xx
Option 09 User Manual	English	020-2971-xx
Service Manual	English	Visit Tektronix website

**Warranty**

One-year parts and labor.



Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.



Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.



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**For Further Information.** Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tektronix.com](http://www.tektronix.com)



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